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November 17, 1998

EX PARTE OR LATE FILED

BY HAND DELIVERY

Ms. Magalie R. Salas
Secretary
Federal Communications Commission
Room 222
1919 M Street, N.W.
Washington, D.C. 20554

Re: Notice of Ex Parte Communications Regarding the Petition for Forbearance of the Cellular Telecommunications Industry Association (filed Dec. 16, 1997), in Telephone Number Portability, CC Docket No. 95-116

Dear Ms. Salas:

Please accept this ex parte notice for filing in CC Docket No. 95-116.

I have hereby submitted two copies of this notice to the Secretary, as required by the Commission's rules. Please return a date-stamped copy of the enclosed (copy provided).

Please contact the undersigned if you have any questions.

Respectfully submitted,

Linda L. Oliver
Counsel for Telecommunications
Resellers Association

Enclosure

No. of Copies rec'd 0+3
List ABCDE

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

November 24, 1998

BY HAND DELIVERY

The Honorable William E. Kennard
Chairman
Federal Communications Commission
1919 M Street, N.W., Room 814
Washington, D.C. 20554

Re: Notice of Ex Parte Communication Regarding the Petition for Forbearance of the Cellular Telecommunications Industry Association (filed Dec. 16, 1997), in Telephone Number Portability, CC Docket No. 95-116

Dear Chairman Kennard:

The Telecommunications Resellers Association ("TRA") strongly supports the Commission's decision in the referenced docket to mandate wireless number portability. TRA is concerned, however, that the implementation of wireless number portability may be unnecessarily delayed. Indeed, the Commission has before it a petition for forbearance filed by the Cellular Telecommunications Industry Association ("CTIA") asking the Commission to postpone by at least five years the implementation date for wireless number portability.

In the enclosed report, the Telecommunications Resellers Association offers an alternative method for achieving wireless number portability within the March 31, 2000 time frame mandated by the FCC and at a reasonable cost to the industry. This method -- which we call "LRN Relay" -- is based on the same

technology used to accomplish wireline local number portability (the "location routing number" or "LRN" methodology). As TRA demonstrates in the report:

- LRN-Relay satisfies all of the FCC criteria for a number portability method.
- LRN-Relay is technically feasible.
- LRN-Relay can easily meet the FCC's current deadline for implementation.
- LRN-Relay does not require a simultaneous flash-cut implementation by all carriers.
- LRN-Relay, because it can lead to faster wireless number portability, can relieve pressure on limited numbering resources and speed number pooling efforts.
- LRN-Relay only requires carriers providing service in markets where number portability must be made available to modify their networks.
- LRN-Relay implementation costs are lower because the methodology builds on the existing infrastructure and on the method used for wireline portability.
- LRN-Relay concentrates the benefits of wireless portability in those geographic areas with the most customers.

TRA encourages the Commission promptly to put the report out for public comment.

The LRN-Relay Methodology

The main hurdle to implementing wireless number portability is accomplishing roamer registration in a number portability environment. The LRN-Relay method described in this report is based on the location routing number methodology agreed to by the North American Numbering Council and the industry for call routing to ported numbers. It relies on infrastructure and procedures that wireless carriers must already have in place by December 31, 1998. The modifications required to implement wireless number portability through this method can be accomplished at relatively low cost and within the time frame currently provided for implementation.

In contrast to the LRN-Relay method proposed in the enclosed report, the "MIN/MDN" number portability method currently being pursued by the wireless industry must be implemented by every wireless carrier, large or small, rural or urban, on a flash-cut basis, before any customer can benefit from wireless number portability. If the Commission concludes that implementation of wireless number portability is feasible by the Commission's deadline using the MIN/MDN methodology, TRA has no objection to an industry decision to employ this method.

However, in the interests of accomplishing number portability as quickly as possible, and with the fewest burdens on smaller carriers, TRA offers the LRN-Relay alternative. Unlike the MIN/MDN method for accomplishing roamer registration, the LRN-Relay method does not require universal, simultaneous implementation by all carriers. Only the carriers providing service in markets where number portability must be made available would need to modify their networks to implement portability.

The Need for Wireless Number Portability

As the Commission already has recognized, the consumer and competitive benefits of wireless number portability are just as significant as they are for wireline number portability. With wireless portability, consumers will be much more likely to take advantage of lower price, better service, and improved coverage areas offered by competitors. Consumers should not be penalized for switching to a better service provider by having to change their telephone number. Wireless number portability also lays the groundwork for robust competition by removing the inherent incumbent advantage attributable to non-portable numbers. Finally, number portability frees up limited numbering resources and facilitates number pooling.

As wireless services continue to penetrate the mainstream of American consumers, the disadvantages of a lack of wireless number portability will only grow more serious. The Strategis Group predicts, for example, that total wireless penetration will reach 40 percent by the year 2002, with a 55 percent penetration of households. 1/ This many consumers should not be burdened with changing their telephone number whenever they want to take advantage of a competitor's offer.

As the Commission also has recognized, wireless number portability is essential to ensuring that wireless technologies can compete with local wireline technologies in the local market. Increasingly, wireless services are substituting for wireline services.

1/ "PCS Pileup," PCS Edge, October 26, 1998, at 7.

Conclusion

The Commission should not let the opportunity pass to inject competition and consumer choice into the wireless market. TRA encourages the Commission promptly to put the enclosed report out for public comment, and to seriously consider the value of the LRN-Relay method for implementing number portability.

Whatever technology the industry chooses for wireless number portability, the FCC should adhere to its current implementation date, and should deny the CTIA petition for forbearance. The Commission must not delay further the consumer benefits of wireless number portability.

Sincerely yours,

David Gusky/LRO

David Gusky
Vice President

Enclosure
cc: Commissioner Susan Ness
Commissioner Harold Furchtgott-Roth
Commissioner Michael K. Powell
Commissioner Gloria Tristani
Magalie R. Salas, Secretary
Daniel Phythyon
David Furth
Clint Odum
Jeanine Poltronieri
Lawrence Strickling
Patrick Forster
Anna Gomez
Gayle Radley Teicher
Michael Altschul, CTIA

Wireless Number Portability

The Case for LRN-Relay

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November 24, 1998

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INTRODUCTION AND SUMMARY

The Federal Communications Commission has consistently recognized that number portability is essential to promoting consumer choice and the development of a healthy, competitive market for telecommunications services. In this report, the Telecommunications Resellers Association offers an alternative method for achieving wireless number portability within the March 31, 2000 time frame mandated by the FCC and at a reasonable cost to the industry. This method -- which we call "LRN Relay" -- is based on the same technology used to accomplish wireline local number portability (the "location routing number" or "LRN" methodology). As TRA demonstrates in this report:

- LRN-Relay satisfies all of the FCC criteria for a number portability method.
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- LRN-Relay concentrates the benefits of wireless portability in those geographic areas with the most customers.

The LRN-Relay Methodology

The main hurdle to implementing wireless number portability is accomplishing roamer registration in a number portability environment. The LRN-Relay method described in this report is based on the location routing number methodology agreed to by the North American Numbering Council and the industry for call routing to ported numbers. It relies on infrastructure and procedures that wireless carriers must already have in place by December 31, 1998. The modifications required to implement wireless number portability

through this method can be accomplished at relatively low cost and within the time frame currently provided for implementation.

In contrast to the LRN-Relay method proposed in this report, the "MIN/MDN" number portability method currently being pursued by the wireless industry must be implemented by every wireless carrier, large or small, rural or urban, on a flash-cut basis, before any customer can benefit from wireless number portability. If the Commission concludes that implementation of wireless number portability is feasible by the Commission's deadline using the MIN/MDN methodology, TRA has no objection to an industry decision to employ this method.

However, in the interests of accomplishing number portability as quickly as possible, and with the fewest burdens on smaller carriers, TRA offers the LRN-Relay alternative. Unlike the MIN/MDN method for accomplishing roamer registration, the LRN-Relay method does not require universal, simultaneous implementation by all carriers. Only the carriers providing service in markets where number portability must be made available would need to modify their networks to implement portability. Carriers serving smaller markets would not be required to upgrade their networks to implement number portability. The LRN-Relay method also lends itself to a phased-in implementation schedule, because only carriers in areas where number portability is required need implement it.

The Need for Wireless Number Portability

As the Commission already has recognized, the consumer and competitive benefits of wireless number portability are just as significant as they are for wireline number portability. With wireless portability, consumers will be much more likely to take advantage of lower price, better service, and improved coverage areas offered by competitors. Consumers should not be penalized for switching to a better service provider by having to change their telephone number. Wireless number portability also lays the groundwork for robust competition by removing the inherent incumbent advantage attributable to non-portable numbers. Finally, number portability frees up limited numbering resources and facilitates number pooling.

As wireless services continue to penetrate the mainstream of American consumers, the disadvantages of a lack of wireless number portability will only grow more serious. The Strategis Group predicts, for example, that total wireless penetration will reach 40 percent by the year 2002, with a 55 percent penetration of households.[1] This many consumers should not be burdened with changing their telephone number whenever they want to take advantage of a competitor's offer.

As the Commission also has recognized, wireless number portability is essential to ensuring that wireless technologies can compete with local wireline technologies in the local market. Increasingly, wireless services are substituting for wireline services.

[1] "PCS Pileup," PCS Edge, October 26, 1998, at 7.

Conclusion

The Commission should not let the opportunity pass to inject competition and consumer choice into the wireless market. TRA encourages the Commission promptly to put the enclosed report out for public comment, and to seriously consider the value of the LRN-Relay method for implementing number portability. Whatever technology the industry chooses, the FCC should adhere to its current implementation date, and not delay further the consumer benefits of wireless number portability.

1 BACKGROUND

1.1 FCC Proceedings

The Federal Communications Commission (FCC or Commission) initiated the first telephone number portability proceeding on July 13, 1995, when it adopted a Notice of Proposed Rulemaking seeking comment on a wide variety of policy and technical issues concerning number portability.[2] In that Notice, the Commission defined three types of telephone number portability: 1) service provider – the ability to retain one's number when changing service providers; 2) service – the ability to retain one's number when changing services; and 3) location – the ability to retain one's number when changing physical locations.

On February 8, 1996, some seven months later, Congress enacted the Telecommunications Act of 1996. One of the primary goals of the Act was to establish "a pro-competitive, de-regulatory national policy framework" that is intended to "promote competition and reduce regulation...to secure lower prices and higher quality services for American telecommunications consumers and encourage rapid deployment of new telecommunications technologies."[3] To realize this goal, the Act imposed specific obligations and duties on all telecommunications carriers.[4] Among these obligations, was the duty of Local Exchange Carriers (LECs) "to provide, to the extent technically feasible, number portability in accordance with requirements prescribed by the Commission."[5] Number portability was defined by the Act as "the ability of users of telecommunications services to retain, at the same location, existing telecommunications numbers without impairment of quality, reliability or convenience when switching from one telecommunications carrier to another."[6]

The FCC promulgated rules and regulations on July 2, 1996, implementing the number portability provisions of the Act.[7] In that Order, the Commission required all LECs to begin the phased deployment of a long-term service provider number portability method in the 100 largest Metropolitan Statistical Areas (MSAs) no later than October 1, 1997, and to complete deployment in those MSAs by December 31, 1998.

The FCC further concluded that public interest is served by requiring the provision of number portability by Commercial Mobile Radio Services (CMRS) providers because number portability will promote competition in the wireless market and will promote competition in the local exchange market. Recognizing that the wireline industry had already begun to develop the processes and systems necessary to provide number

[2] Telephone Number Portability, CC Docket No. 95-116, 10 FCC Rcd 12350 (1995) (Notice).
[3] S. Conf. Rep. No. 230, 104th Cong., 2nd Sess. (1996).
[4] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996) (1996 Act or Act).
[5] 47 U.S.C. Section 251(b)(2).
[6] 47 U.S.C. Section 153(30).
[7] Telephone Number Portability, *First Report and Order and Further Notice of Proposed Rulemaking*, C.C. Docket No. 95-116, July 2, 1996, FCC 96-286, paragraph 46 (*First Report and Order* or *July 2, 1996 Order*).

portability while the CMRS carriers had only begun to address number portability, the FCC established a separate schedule for CMRS provider portability. Under this schedule, all cellular, broadband Personal Communications Service (PCS), and covered Specialized Mobile Radio (SMR) carriers must be capable of routing calls from their networks to ported numbers anywhere in the country by December 31, 1998, and offer service provider number portability throughout their networks by June 30, 1999.

1.2 FCC Performance Criteria

The FCC did not adopt a specific methodology for implementing number portability in its *First Report and Order*. Rather, the Commission established performance criteria that all number portability implementation methods must meet.[6] Under these criteria, number portability implementation methods must:

1) support existing network services, features, and capabilities;

2) efficiently use numbering resources;

3) not require end users to change their telecommunications numbers when switching service providers;

4) not result in unreasonable degradation in service quality or network reliability when implemented;

5) not result in any degradation of service quality or network reliability when customers switch carriers;

6) not result in a carrier having a proprietary ownership interest in the number portability method;

7) be able to accommodate location and service portability in the future; and

8) have no significant adverse impact outside the areas where number portability is deployed.

These criteria, and how they relate to implementation of the LRN-Relay solution, are discussed in section 5 of this report.

[6] Ibid., paragraph 48. One additional criterion was included on the original FCC list, but was eliminated by the Commission's *First Memorandum Opinion and Order on Reconsideration*, Telephone Number Portability, CC Docket 95-116, RM –8535, FCC 97-74, March 11, 1997, paragraph 19. That criterion would have required that telecommunications carriers not rely on databases, other network facilities, or services provided by other telecommunications carriers in order to route calls to the proper termination point.

1.3 CMRS Number Portability Requirement

On March 11 1997, the FCC released its *First Memorandum Opinion and Order on Reconsideration*,[9] affirming its schedule for long-term number portability implementation by CMRS providers and clarifying aspects of its *First Report and Order*. Specifically, the Commission stated:

> We decline at this time to alter the implementation schedule imposed by the *First Report and Order* for wireless carriers. We recognize that the wireless industry has lagged behind the wireline industry in developing a method for providing number portability, and that the wireless industry faces special technical challenges in doing so. Nonetheless, we find that the schedule for implementation of number portability by cellular, broadband PCS, and covered SMR providers is reasonable and takes into account the current stage of development for wireless number portability.[10]
>
> We require cellular, broadband PCS, and covered SMR providers to have the capability to query the number portability databases nationwide, or arrange with other carriers to perform the queries, by December 31, 1998, in order to route calls from wireless customers to customers who have ported their numbers.[11]
>
> We [further] clarify that, by June 30, 1999, CMRS providers must (1) offer service provider portability in the 100 largest MSAs, and (2) be able to support nationwide roaming.[12]

1.4 CTIA Petitions

On November 24, 1997, the Cellular Telecommunications Industry Association (CTIA) filed a Petition for Extension of Implementation Deadlines with the Chief, Wireless Telecommunications Bureau.[13] In addition, on December 16, 1997, CTIA requested that the FCC forbear from enforcing its June 30, 1999 implementation deadline at least until after the five-year buildout period for PCS carriers expired. The Commission approved CTIA's petition for a nine-month extension of the implementation deadline on September 1, 1998.[14] The new deadline for number portability implementation is now March 31, 2000. CTIA's forbearance request is pending.

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[9] Telephone Number Portability, *First Memorandum Opinion and Order on Reconsideration*, CC Docket 95-116, RM –8535, FCC 97-74, March 11, 1997 (*First Order on Reconsideration*).
[10] Ibid., paragraph 134.
[11] Ibid., paragraph 136, emphasis added.
[12] Ibid., paragraph 136, emphasis added.
[13] The FCC delegated authority to the Chief, Wireless Telecommunication Bureau, to waive or stay implementation dates, as deemed necessary to ensure the efficient development of number portability, for a period not to exceed nine (9) months.
[14] Telephone Number Portability, *Memorandum Opinion and Order*, C.C. Docket No. 95-116, September 1, 1998, DA 98-1763.

2 NUMBER PORTABILITY IMPLEMENTATION

In deciding how best to implement wireless service provider number portability, it is important to remember that this is only part of the larger number portability effort that is already being implemented on a phased basis. Indeed, as the previous section indicates, wireless providers must provide call routing to ported numbers by December 31, 1998. Many carriers already are capable of doing this. Others are actively negotiating arrangements with third party providers to do so.

It is within this context that wireless service provider number portability must be examined. Because much of the infrastructure and related carrier agreements that enable call routing to ported numbers will be in place by the first of the year, wireless service provider number portability should only be viewed as an incremental effort.

These two implementation stages are described below.

2.1 Call Routing for Ported Numbers

Call routing refers to the process of setting up the voice channel over which a conversation takes place. In today's network, this is accomplished by using two separate, but parallel, networks – the voice network and the Signaling System 7 (SS7) network.[15] The voice network handles the actual conversation traffic. This is a circuit-based network that assigns a specific circuit which is used for the length of the conversation. The SS7 network is a packet-based network that handles non-call associated signaling – call setup, special features, and other network functions – so the voice network doesn't have to dedicate an entire voice channel to perform these functions.

With the advent of local number portability, a method of determining whether the telephone number of a called party was ported to another carrier was necessary. The North American Numbering Council (NANC), the industry and the state/regional working groups collectively agreed on the Location Routing Number (LRN) as the preferred method.

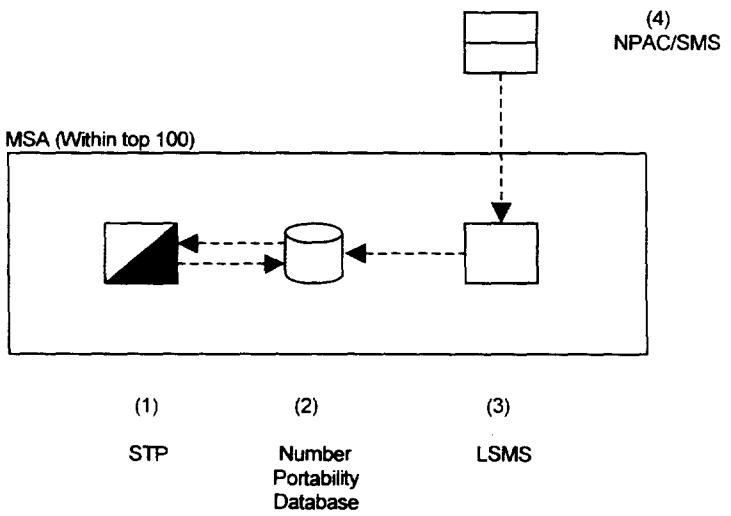
The LRN method is an SS7 implementation. Under this method, each end office switch is assigned a unique 10-digit number (an LRN) that identifies the specific location of the switch on the network. This routing number serves as the network address of that switch for routing purposes. A database of ported telephone numbers and corresponding

[15] To varying degrees, nearly every modern communications system - wireline and wireless systems included - uses two distinct networks to provide service. Each of these networks - the voice network and the Signaling System 7 (SS7) network – fulfills a different transmission requirement. The voice network is responsible for call routing functions - the process of defining and establishing a voice path over which a conversation can take place. The SS7 network handles non-call associated signaling functions - the process of identifying a caller's specific service parameters and determining the network functions necessary to provide the relevant services.

addressing information is used to provide network mappings for ported numbers.[16] Carriers query this database for calls to end offices from which at least one customer has ported their number to another carrier.

The database query is performed by what is called the "N-1" carrier. The N-1 carrier is essentially the last carrier to handle the call before it is handed off to the terminating carrier. For long distance calls, the N-1 carrier is usually the interexchange carrier. For calls from wireless subscribers to wireline customers, the wireless service provider is usually the N-1 carrier. Again, wireless service providers must have the ability to function as the N-1 carrier for calls to ported numbers, either themselves or through arrangements with other carriers, by December 31, 1998.[17]

The network elements required to provide call routing to ported numbers are illustrated below.



When a wireless subscriber originates a local call to a wireline customer whose number has been ported, the wireless carrier must function as the N-1 carrier for the call. In this capacity, the carrier's STP(1) initiates a database query to its local number portability

[16] This database may or may not be associated with one of the seven regional Number Portability Administration Center (NPAC) databases – the regional number portability databases maintained by the Lockheed Martin IMS. Carriers may create and maintain their own local number portability databases and simply interface with a Local Service Management System (LSMS) for NPAC connectivity. Alternatively, carriers may contract with other carriers or third party providers to provide this database and LSMS/NPAC connectivity.

[17] *First Order on Reconsideration*, paragraph 136.

database(2) to determine the appropriate LRN of the new carrier – the recipient carrier.[18] To do this, the carrier must have such a database, or have access to such a database, and the database must maintain current ported subscriber to recipient carrier LRN mappings.

A regional Number Portability Administration Center (NPAC) Service Management System (SMS)(4) provides these mappings through the carrier's Local Service Management System (LSMS)(3). Once the appropriate LRN is determined, the carrier initiates call setup procedures with the terminating carrier.

2.2 Service Provider Number Portability

Service provider number portability refers to the ability of an individual to keep an existing telephone number if the individual switches to another carrier within the same general service area. Wireline carriers provide this type of number portability also through the LRN methodology. In contrast to wireless carriers, local exchange carriers rarely change end office locations and their service territories are fairly well defined. The LRN methodology alone therefore is insufficient to enable service provider number portability for wireless subscribers.

Wireless subscribers have the ability to obtain service outside the service territory of their own provider (i.e. to roam). As a result, wireless carriers must have the additional capability to provide roaming services to customers that have ported their numbers to other carriers. Indeed, maintaining nationwide roaming in a number portability environment will require that all wireless carriers – those within and outside the largest 100 MSAs – have a method of registering and validating roaming customers.

Currently there are two proposed methods of providing service provider number portability – LRN-Relay and MIN/MDN Separation. These methods are discussed in the following sections.

2.2.1 LRN-Relay

The LRN-Relay solution, as the name implies, is based on the LRN methodology described above. This solution builds on the same procedures and infrastructure that wireless service providers are required to have, or arrange, for call routing purposes. The primary function of this solution, however, is enabling the registration of roaming subscribers with ported numbers, not the routing of calls to ported numbers.

The LRN-Relay solution is an SS7-based approach. It defines a specific carrier that must perform database queries, similar to an N-1 carrier. In the absence of query capabilities in

[18] The recipient carrier is the provider to whom a subscriber ports a number. The subscriber may, or may not, be porting to the recipient from the original carrier. The subscriber may be porting from another recipient carrier. However, the original carrier – the donor carrier – remains the same regardless of the number of times a subscriber ports a number.

the N-1 carrier, the default carrier – the donor carrier[19] – provides the LRN query capability. Because the donor carrier has this responsibility, roamer registration is fairly straightforward.

Briefly, the registration process under LRN-Relay is as follows. When a carrier receives a registration message from a roaming subscriber and does not have query capability to a number portability database, it simply forwards that notification to the default network of the subscriber. The default network in this case would be the donor carrier's Home Location Register (HLR).[20] When the donor carrier receives the registration notification it performs a database query to determine the HLR of the subscriber's new carrier – the recipient carrier. Once the appropriate HLR is identified, the registration notification is forwarded to that location for validation. Upon validation, a registration response is sent back to the serving carrier. This process will be discussed in greater detail in section 4.

2.2.2 MIN/MDN Separation

The MIN/MDN (Mobile Identification Number/Mobile Directory Number) separation scenario, as CTIA describes it, refers to the disjoining of what are essentially the network and subscriber elements of a cellular phone number. The MIN, in this scenario, is a non-dialable 10-digit number that uniquely identifies a subscriber's handset and is used for signaling purposes on the network.[21] The MDN is a dialable 10-digit number that is the subscriber's mobile "telephone" number.

Most wireless systems today treat the MIN and MDN as identical.[22] However, these numbers have taken on renewed importance since the Commission ordered wireless service provider number portability.

Under MIN/MDN separation, the MIN of a subscriber that ports to another service provider stays with the original provider. In other words, the donor carrier keeps the MIN, but gives up the MDN. The recipient carrier then assigns the subscriber a new MIN, one that corresponds to the recipient carrier's switch. This number is transparent to the subscriber because the subscriber only uses the MDN, which is taken to the new provider. With this new assignment, network signaling will still be based on the MIN, but with a new MIN from the new provider. Again, the subscriber's MDN will not change.

Roamer registration under MIN/MDN separation is performed in a similar manner as it is today. However, the serving carrier has the additional responsibility of determining the location of the recipient carrier's HLR. Also, the recipient carrier must now map a new MIN to a separate data element – the MDN. Briefly, the registration process under MIN/MDN

[19] The donor carrier is the provider to whom the originally MIN/MDN was assigned. The donor carrier remains the same regardless of the number of times a subscriber ports a number. This fact is significant in that the donor carrier must always act as the carrier of last resort with respect to database queries and message forwarding to the recipient carrier for ported numbers.
[20] An HLR is a database that contains subscriber account information and profiles.
[21] The Mobile Station Identification (MSID) number is used in some systems.
[22] Global System for Mobile Communications (GSM) networks recognize separate MINs and MDNs.

separation is as follows. When a carrier receives a registration message from a roaming subscriber it must recognize a separate MIN and MDN to determine the location of the appropriate HLR. Once this location is determined, the registration notification is forwarded to the recipient carrier for validation. Upon validation, a registration response is sent back to the serving carrier.

To perform network signaling for ported numbers all wireless carriers must have the capability to separate the MIN and MDN. Without this capability, subscribers that have ported their numbers to other carriers would not be able to roam in all areas. Additionally, with MIN/MDN separation, some services could not be provided as they are today.

For example, E911 and 911 services typically involve a modified caller ID mechanism so a caller's number is determined for callback purposes. When the MIN and MDN were identical, there was no consequence to providing the MIN as the callback number. Under MIN/MDN separation, however, this could result in an incorrect callback number.

CTIA and its members are currently developing standards to support MIN/MDN separation. Additionally, procedures that would prevent service incompatibilities like the previous example are under consideration. It is unclear at this time, however, when these standards and procedures might be finalized and implemented.

3 THE LRN-RELAY SOLUTION

3.1 Overview

As indicated in the previous section, LRN-Relay is based on the LRN methodology. It is an SS7-based approach. It relies on the infrastructure and procedures that will be used by wireless carriers for call routing purposes. It defines a specific carrier that must perform database queries. And only minor changes to the NPAC database parameters are necessary.[23]

The LRN-Relay solution does not require development and implementation of new technological capabilities. It does not require carriers outside the 100 largest MSAs to modify their existing infrastructures. Carriers with service areas within the 100 largest MSAs would be required to make minor changes to the functionality of their STPs to support nation-wide roaming.

3.2 Detailed

The LRN-Relay solution adds an additional feature to the LRN methodology for signal routing purposes to accommodate roamer registrations in a wireless number portability setting. Specifically, the LRN-Relay solution requires that the serving carrier must be able to obtain the location of the HLR of a subscriber's new service provider. To do this, a new data field must be created in the NPAC database for this mapping.

The NPAC database maintains routing data and related information for each subscriber that has ported their number in what is called a "subscription version." These data associate customer specific information with carrier locations and parameters. A subscription version exists for every customer that ports to another carrier.

The subscription version format already defines fields for specific parameters. These parameters include information for: LRN; Line Information Database (LIDB); Calling Name (CNAM); and, Inter-System Voice Message (ISVM). The NPAC is currently adding Change Order No. 203, to support wireless short message service. LRN-Relay would simply require the creation of an additional parameter for the Destination Point Code (DPC) and Sub-System Number (SSN) of an HLR, which would associate the appropriate location of a recipient carrier's HLR.

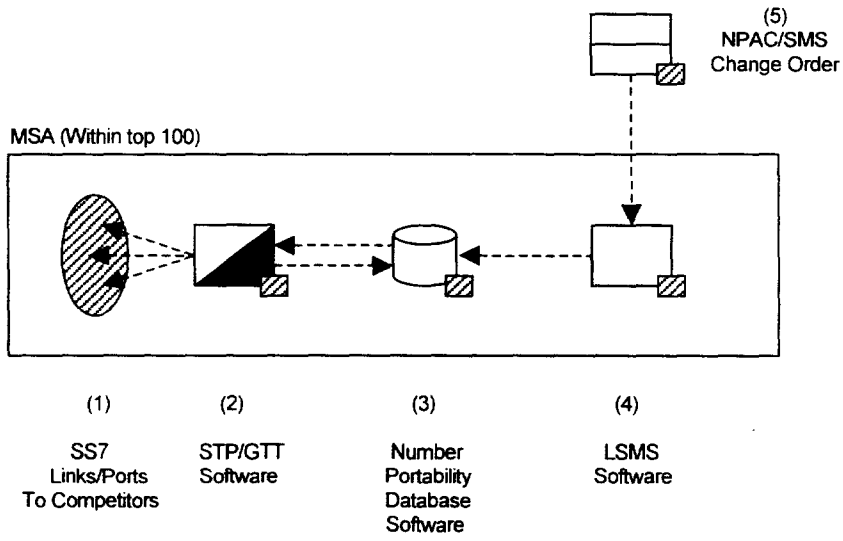
It must be noted that these additional capabilities only apply to carriers that serve areas where number portability is available. Indeed, carriers outside the 100 largest MSAs may route their signaling messages the same way they do today (i.e. default routing to the donor carrier).

[23] The HLR parameter would require implementation of an NPAC change order.

For carriers that do serve areas within the 100 largest MSAs, the LRN-Relay solution will require the following:

- a software change order at the NPAC(5) to create a new data field in the subscription version structure to associate a ported subscriber's number with the location of the recipient carrier's HLR;
- modifications to the local number portability database(3) and LSMS(4) software to recognize the new subscription version field;
- new software at the STP to perform GTT(2) queries on the local number portability database; and
- SS7 links and ports(1) connecting the carrier's STP to the STPs of competing carriers so registration notification requests can be forwarded.

The diagram below illustrates the network functions necessary for signal routing under the LRN-Relay solution. The diagonally shaded boxes and oval represent these functions.



Again, it is important to recognize that these modifications are only required of carriers that serve areas within the 100 largest MSAs. In addition, these modifications are incremental to the investments already made by these carriers for call routing purposes to ported numbers. The only new hardware that may be involved are the SS7 links and ports.[24]

[24] Depending on network configuration and capacity, additional hardware may potentially be necessary to enable GTT queries. However, such instances are not expected to be common nor are the costs expected to be significant.

4 ROAMER REGISTRATION

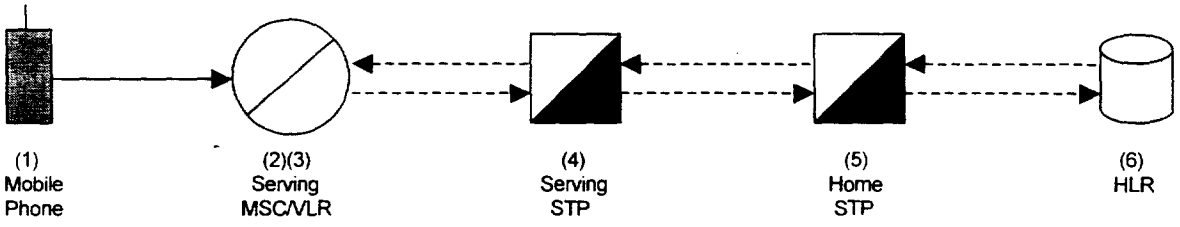
The central technical hurdle to wireless number portability implementation relates to roamer registration. Indeed, because wireless subscribers are able to receive services outside their own carrier's network, wireless number portability implementation must ensure this functionality. The LRN-Relay solution ensures this functionality by:

- maintaining the existing signaling procedures of carriers outside the 100 largest MSAs;
- requiring donor carriers to ensure that database queries are performed and registration notifications are forwarded to appropriate HLRs for ported numbers; and
- providing carrier flexibility to contract with third party providers, or other carriers, to perform database queries.

These characteristics are best illustrated by comparing the current roamer registration process with roamer registration under the LRN-Relay solution. A comparison of the pre- and post-LRN-Relay roamer registration procedures are described in the following sections.

4.1 Current Roamer Registration Procedures

The diagram below illustrates the network elements typically employed in the current roamer registration process.[25]



[25] The diagram and descriptive text refer to the roamer registration process in a typical network. These network elements and procedures may differ to some extent depending on the transmission characteristics of a specific network. However, these variations should have minimal impact on the functional tasks described above.

4.1.1 Mobile Phone(1)

Before a mobile subscriber is able to place or receive calls in a roaming environment, the subscriber must be validated by the subscriber's carrier as an authorized customer and the mobile handset must be registered as active on the serving network. This process is initiated every time the subscriber's phone is turned on. Once the handset is turned on, a registration message is sent to the nearest Mobile Switching Center (MSC).

4.1.2 Serving MSC(2)

When the serving MSC receives the registration notification from a mobile handset, it analyzes the subscriber's MIN to determine whether the subscriber is one of its own customers. If the subscriber is not one of the serving MSC's subscribers, it assumes the subscriber is roaming and searches its Visitor Location Register (VLR)(3) for a recently processed registration. If none exists, the serving MSC forwards the registration notification to its serving Signaling Transfer Point (STP) for transmission over the SS7 network.

4.1.3 Serving STP(4)

Having received the registration notification from its serving MSC, the serving STP performs a six-digit Global Title Translation (GTT) to determine the subscriber's home network.[26] With this information, the serving STP forwards the registration notification to the home STP.

4.1.4 Home STP(5)

Once the registration notification is received by the home STP, it determines the appropriate HLR and forwards the registration notification to that location.

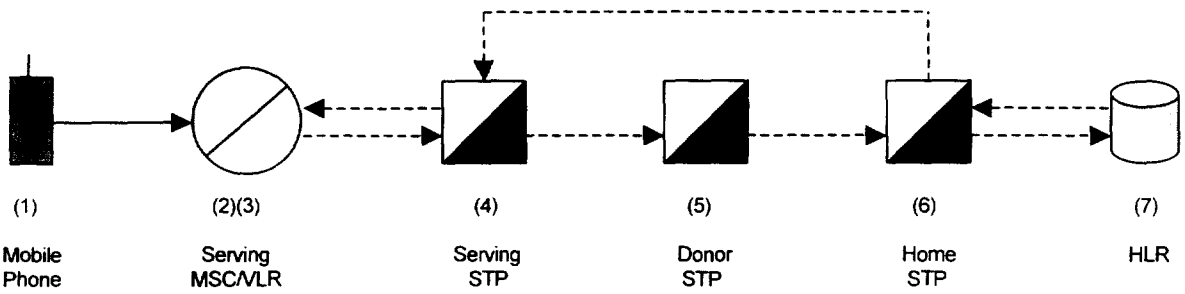
4.1.5 HLR(6)

When the registration notification is received, the HLR retrieves the relevant subscriber information, validates the information and forwards a response to the serving MSC so the subscriber can receive service in the serving network.

[26] A serving carrier may use a six-digit GTT in the STP to determine the home network. Some carriers may employ a table lookup immediately in their MSC or utilize the translation services of a third party.

4.2 LRN-Relay Roamer Registration Procedures

The diagram below illustrates the network elements required under the LRN-Relay solution for roamer registration in a number portability environment.[27] As the diagram indicates, the network elements are essentially the same elements used today. Only the addition of the donor STP is different.



4.2.1 Mobile Phone(1)

As with current roamer registration procedures, a registration message would be sent to the nearest MSC under the LRN-Relay solution when a mobile handset is turned on.

4.2.2 Serving MSC(2)

Current procedures at the serving MSC would not be altered by the LRN-Relay solution. The serving MSC would still go through the process of analyzing the subscriber's MIN, searching its VLR(3) and forwarding the registration notification to its local STP as currently performed.

4.2.3 Serving STP(4)

The serving STP function would also remain unchanged under the LRN-Relay solution. The serving STP would still perform the six-digit GTT,[28] and would still forward the registration notification to the location specified by the GTT. The only difference under the

[27] The diagram and descriptive text above refer to the network elements and procedures that would be required for roamer registration under the LRN-Relay solution for most wireless carriers. The specific network elements and procedures that will actually be employed by a given carrier will depend on the transmission method and network architecture of the carrier's system. However, these variations should have minimal impact on the functional tasks that must be performed.

[28] A serving carrier may use a six-digit GTT in the STP to determine the home network. Some carriers may employ a table lookup immediately in their MSC or utilize the translation services of a third party.

LRN-Relay solution is the fact that the GTT wouldn't necessarily identify the subscriber's home network. Even though the signaling information provided by the GTT would be identical to the information provided by the GTT under current roamer registration procedures, the subscriber may have ported to another carrier.

4.2.4 Donor STP(5)

To resolve this potential mismatch, the LRN-Relay solution requires that the donor carrier be responsible for ensuring that the necessary number portability database query takes place and the registration notification is forwarded to the correct HLR. This is the same arrangement that is working in the wireline industry and should be equally effective in the wireless arena.[29]

To fulfill its responsibilities, the donor carrier could either perform the query at the STP or arrange for another party to perform that function. In any event, the donor carrier would be permitted to recover their specific database query costs from the serving carrier requesting the LRN-Relay to the recipient carrier's network.

While the donor carrier is ultimately responsible for the database query function under the LRN-Relay solution, serving carriers would not be prevented from contracting directly with a third party provider, such as an SS7 network or "backbone" provider, to perform this function, or providing the function themselves. These alternatives would encourage donor carriers to reduce database query costs and could serve as a check against anti-competitive behavior. Arrangements like this are already occurring to facilitate N-1 number portability call routing, and the Commission has defined a compensation mechanism.[30]

4.2.5 Home STP(6)

Once the donor STP or third party provider forwards the registration notification, the home STP performs the same tasks as currently performed.

4.2.6 HLR(7)

As with current procedures, the HLR retrieves the relevant subscriber information, validates the information and forwards a response, around the donor STP, to the serving MSC.

[29] In fact, the wireless industry envisions deploying a similar architecture to support its wireless short message service.
[30] *First Order on Reconsideration*, paragraph 126; Telephone Number Portability, *Second Report and Order*, CC Docket 95-116, RM –8535, FCC 97-289, August 18, 1997, paragraph 78.

5 THE LRN-RELAY SOLUTION MEETS FCC PERFORMANCE CRITERIA

The FCC has required that any number portability solution must satisfy eight specific criteria.[31] The LRN-Relay solution fully satisfies each of these criteria. The following sections describe in detail how the LRN-Relay meets the FCC performance criteria. It should be noted that criteria 6 and 7 – relating to degradation of service quality and network reliability – have been combined in section 5.4.

5.1 Existing network services, features, and capabilities

The Commission's *First Report and Order* identifies a number of existing network services, features and capabilities that must be supported in a wireless number portability setting.[32] These include: emergency services; CLASS features; operator and directory assistance services; and, intercept capabilities. The provision of these services and features will not be affected by the LRN-Relay solution. Indeed, current wireless signaling schemes are preserved under the LRN-Relay solution, and only minor modifications to donor carrier responsibilities are required. The characteristics of these services and the attendant relationship to the LRN-Relay solution are discussed below.

5.1.1 911 and E911

Effective and reliable emergency services rely on the ability of a Public Service Access Point (PSAP) to maintain communication with a calling party during the course of an emergency and to notify the appropriate authorities of the emergency situation. This requires the capability to identify the telephone number and relative location of the calling party.

Provision of 911 and E911 services under the LRN-Relay solution will not be affected. Indeed, because the LRN-Relay solution supports current signaling schemes, which assume identical MINs and MDNs, emergency services could be provided in a number portability environment in the same fashion as they are today. There would be no need to modify MSCs to ensure that the MDN is forwarded to the PSAP instead of the MIN because these numbers are identical.

In addition, because there is no requirement to separate the MIN and MDN under the LRN-Relay solution, the Commission's open docket to revise its E911 rules should not be affected.[33] Regardless of the outcome of that proceeding, the LRN-Relay solution does not introduce a new signaling methodology and therefore would not require additional integration efforts to ensure compatibility with existing emergency calling systems.

[31] *First Report and Order*, paragraph 48; *First Order on Reconsideration*, paragraph 19.
[32] *First Report and Order*, paragraphs 48-50.
[33] Revision of the Commission's Rules to Ensure Compatibility With Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102.

5.1.2 CLASS Features

Custom Local Area Signaling Services (CLASS) generically refer to several enhanced features such as incoming-call identification (Caller ID), call trace, call blocking, automatic call return, call redial, distinctive ringing, call waiting and selective call forwarding. These services are provided via the SS7 network.

To the extent that CLASS features are provided in a wireless setting, the LRN-Relay solution does not affect these features. As with other non-call associated signaling procedures, provision of CLASS features require that the MDN of the calling/called party be forwarded to the MSC. Because the LRN-Relay solution maintains the existing MIN/MDN relationship, there is no need to translate the MDN and MIN during signaling.

5.1.3 Operator and Directory Assistance

Operator and Directory Assistance services are also provided over the SS7 network. To the extent these services are provided in a wireless setting, there is no impact as a result of LRN-Relay implementation. As with CLASS features, operator and directory assistance services require that the MDN be forwarded to the MSC and not the MIN. Because there is no MIN/MDN separation under the LRN-Relay solution, these services are not affected.

5.1.4 Intercept Capabilities

Like the services mentioned above, call intercept capability is based on the non-call associated signaling procedures of the SS7 network. Again, because there is no MIN/MDN separation under the LRN-Relay solution, these services are not affected.

5.2 Numbering resources

The *First Report and Order* requires that any long-term number portability implementation method efficiently use numbering resources. Indeed, the order states "...we conclude that deploying a long-term number portability method that rapidly depletes numbering resources would undermine the efforts of the industry, the states, and the Commission to ensure sufficient numbering resources."[34] The LRN-Relay solution meets this criterion.

Currently, numbering administration is performed by the North American Numbering Plan Administration (NANPA). Numbering resources are distributed on an NPA/NXX basis, in blocks of 10,000 numbers, and each MSC is assigned a unique NPA/NXX combination. Separate administration of MINs and MDNs is not required under the LRN-Relay solution, as these numbers are identical. As a result, current numbering administration procedures under the LRN-Relay solution will not be affected.

[34] *First Report and Order*, paragraph 51.

5.2.1 Number Pooling

Number pooling refers to the process of assigning unique NPA/NXX combinations to more than one carrier or MSC, and distributing numbers to those carriers or MSCs in blocks of 1,000 rather than 10,000. Implementation of pooling for wireless numbering resources is influenced by two factors: 1) administrative mechanisms to assign MINs and MDNs; and 2) the ability to determine carrier responsibility within a pooled NPA/NXX.

There is no separation of the MIN and MDN under the LRN-Relay solution. Therefore there is no need to modify existing administration procedures beyond the segmentation and distribution of numbers within a unique NPA/NXX combination in 1,000 number blocks. Indeed, the existing administration mechanisms would not be affected under the LRN-Relay solution.

The ability to determine carrier responsibility within a pooled NPA/NXX will be provided once number portability is implemented. Indeed, number pooling in this context is simply a broader application of number portability. Because any number portability implementation plan, by definition, will provide this functionality, there is no technical difference among the proposed implementation methods. However, the faster a number portability plan can be deployed, the sooner number pooling can be implemented. To the extent one number portability plan can be implemented more rapidly than another, that plan is preferred.

5.3 Existing telecommunications numbers

As a threshold matter, any wireless number portability implementation method that cannot meet this performance criterion is not a viable method. The LRN-Relay solution ensures that end users will be able to retain their existing telecommunications numbers when switching service providers. Moreover, because the LRN-Relay solution allows for the phased deployment of wireless number portability, end users in the 100 largest MSAs will be able to exercise this option within the Commission's existing schedule.

5.4 Service quality and network reliability

5.4.1 After Implementation

As mentioned above, the LRN-Relay solution is based on a methodology that is successfully delivering number portability to wireline customers today in the majority of the 100 largest MSAs. As a result, no degradation in service quality or network reliability is anticipated when the LRN-Relay solution is implemented. Indeed, not only is the LRN-Relay solution adapted from a proven implementation methodology, it requires minimal modifications to current call processing and signaling schemes.

5.4.2 After customers switch carriers

While the LRN-Relay solution involves one more step than is currently required to perform non-call associated signaling in a wireless number portability environment, no degradation

in service quality or network reliability is anticipated under the LRN-Relay solution. With the exception of donor STP database queries, there would be virtually no functional changes to current signaling procedures when a subscriber ports their number. This step will have no adverse impact on service quality or network reliability and will be transparent to subscribers who've ported their numbers.

5.5 Proprietary ownership interest

The *First Report and Order* requires that any number portability method not confer a proprietary ownership interest in any technology needed for number portability. The LRN-Relay solution does not confer any such proprietary interst on any entity, although it does assign the default responsibility for performing the database query to the donor carrier (much as the wireline number portability scheme assigns a role to the N-1 carrier). As discussed above, while the donor carrier is ultimately responsible for the database query function under the LRN-Relay solution, serving carriers would not be prevented from contracting directly with a third party provider, such as an SS7 network or "backbone" provider, to perform this function, or providing the function themselves.

The LRN-Relay solution recognizes that donor carriers will occupy a unique position in a wireless number portability environment. As such, donor carriers should have the responsibility for ensuring that the necessary database queries for ported numbers are performed and that roamer registration notifications are forwarded to the appropriate HLRs. However, the LRN-Relay solution does not create a proprietary ownership interest for donor carriers.

5.5.1 Carrier of Last Resort

As a public policy matter, an entity that acts as the "carrier of last resort" is necessary to ensure the proper functioning of the nation's communications systems. Incumbent local exchange carriers serve this function for customers and non-customers within their own local exchange service territories. The default N-1 carrier serves this function for wireline customers that have ported their numbers in the current number portability environment. The LRN-Relay solution simply expands this function to include donor carriers for signaling purposes when wireless subscribers port their numbers to other carriers.

5.5.2 Third Party Providers

In addition, while the LRN-Relay solution requires that donor carriers operate as carriers of last resort with respect to non-call associated signaling for ported numbers, carriers are not prohibited from negotiating third party agreements, or conducting the function themselves. Indeed, such alternative arrangements are taking place in the wireline market and may prevent donor carriers from engaging in anti-competitive behavior.

5.6 Location and service portability

The LRN-Relay solution does not significantly alter current call processing and signaling schemes, and therefore does not restrict or constrain future deployment of location and service portability. Indeed, because the LRN-Relay solution enables a phased deployment of service provider number portability – location and service number portability can be deployed over time in a similar way. Moreover, because carriers may realize savings from performing the database queries themselves, or contracting with third party providers, such services may evolve in the marketplace on their own.

5.7 Impact outside 100 largest MSAs

Under the LRN-Relay solution, signaling procedures for carriers that serve locations outside the 100 largest MSAs are not changed. As indicated in the previous section, serving MSCs and STPs could perform the same functions in a number portability environment as they currently perform. Indeed, serving MSCs would still go through the process of analyzing a subscriber's MIN, searching its VLR and forwarding the registration notifications to its serving STP. The serving STPs could still route based on six-digit GTTs.

The only difference under the LRN-Relay solution occurs in a subscriber's home territory, where the donor carrier would have additional responsibilities. However, this fact does not change the operation of serving MSCs and STPs.

6 LRN-RELAY AND MIN/MDN SEPARATION SOLUTIONS COMPARED

6.1 Cost

Regardless of the implementation methodology, the total cost associated with providing service provider number portability depends to a large extent on the business decisions of individual carriers. However, the cost elements – the network functions – that will influence these decisions are defined here in general terms so as to provide the context for cost comparison.

Under the LRN-Relay solution, only carriers with operations within the 100 largest MSAs initially must upgrade their own networks to perform the signaling functions needed for wireless number portability. In contrast, the MIN/MDN separation solution requires *all* carriers in North America to upgrade their networks in order to accomplish wireless number portability in the 100 largest MSAs.[35] The analysis that follows relates to the network functions that would be required under the two implementation methods. It is important to note that carriers will incur costs associated with terminating calls to ported wireless numbers under these implementation methods. However, we assume that these costs will be the same under either method and therefore do not include them in this analysis.

In addition, we note that the infrastructure necessary to provide call routing to ported wireline numbers, or the third party agreements to provide this function, already will be in place by December 31, 1998. Even though call routing takes place for the most part over the voice network, this infrastructure can be utilized for signal routing purposes. Therefore, where overlapping facilities exist, the cost elements associated with service provider number portability are incremental to existing facility investments.

In this analysis, we have attempted to estimate costs using the most conservative assumptions. Further, these costs are expressed on a per POP basis.[36] Based on the most recent census data, there are approximately 162 million POPs in the 100 largest MSAs.[37]

LRN-Relay Solution

As indicated in previous sections, the LRN-Relay solution relies on existing facilities to provide wireless service provider number portability. LRN-Relay adds the additional

[35] It should be noted that the MIN/MDN separation scenario described by CTIA would affect all participants in the North American Numbering Plan. This includes carriers operating outside the United States, such as carriers in Canada, the Caribbean and South Pacific.

[36] The term "POP" refers to the total population within the geographic areas licensed to a wireless provider.

[37] 265,283,783 (total population) X .611 (percentage in 100 largest MSAs – per FCC) = 162,088,391. United State Census Bureau, MA-96-5 Estimates of the Population of Metropolitan Areas: Annual Time Series, July 1, 1991 to July 1, 1996. (Internet release date December 1997). (available at: http://www.census.gov/population/estimates/metro-city/ma96-05.txt); *Third Report and Order*, CC Docket 95-116, RM –8535, FCC 98-82, May 12, 1998, paragraph 477.

functions discussed in section 3 of this report to accommodate subscriber registrations in a wireless number portability setting.

The total cost of the LRN-Relay solution includes two types of costs. We assume that carriers serving the 100 largest MSAs will incur: 1) capital costs associated with upgrading their existing network infrastructure as described above; and, 2) recurring costs associated with SS7 links and database query charges for registering subscribers who have ported their numbers. These cost estimates are discussed below.

1) Capital Costs

To develop an estimate of capital costs, three factors must be determined – the upgrades that will be necessary, the cost of the upgrades, and the number of facilities that must be upgraded. As discussed previously, the upgrades necessary for the LRN-Relay solution have already been identified. To reiterate, these include:

- a software change order at the NPAC to create a new data field in the subscription version structure to associate a ported subscriber's number with the location of the recipient carrier's HLR;
- modifications to the local number portability database and LSMS software to recognize the new subscription version field;
- new software at the STP to perform GTT queries on the local number portability database; and
- SS7 links and ports connecting the STP to the STPs of competing carriers so registration notification requests can be forwarded.

With respect to the software upgrades, we reasonably assume here that upgrades will range between 25 and 50 percent of total software costs. Based on quotes from two vendors, software prices for these functions range between $75,000 and $1.115 million per STP. [38] We assume the larger figure here to provide the most conservative estimate possible. We also assume the higher upgrade cost (i.e., 50 percent of total software cost), which yields a cost of approximately $557,500 per STP for sortware upgrades.

In terms of hardware, the cost of SS7 links and ports must also be estimated. Since SS7 ports are essentially modems, albeit sophisticated ones, we assume each port will cost approximately $2,000. We assume that SS7 links, which are typically leased facilities, are recurring costs and therefore will be excluded here and considered in the recurring cost section.

[38] "Installing LNP on switches can cost anywhere from $75,000 to $750,000 per switch," AG Communication Systems representative. *All work and no pay? Service providers have been dashing to deploy LNP by the deadline. But who's going to foot the bill?*, America's Network, October 1, 1997. List price without purchase of hardware $1,115,000 (GTT software, LNP database software, LSMS software, and NPAC interface software per STP) Tekelec, verbal quote November 17, 1998.

The number of facilities that must be upgraded is necessarily dependent on the specific network topology of each carrier. However, engineering assumptions are made here for comparison purposes.

While some carriers that serve several regions maintain more than one STP pair for signaling purposes, LSMS, GTT and number portability database facilities are typically maintained at the carrier level (i.e., only one pair of STPs per carrier). Therefore, we assume here that each carrier will have one STP pair to provide these functions.

Further, we assume that each carrier will interconnect with its competitors in some fashion. Carriers that serve only one region are unlikely to interconnect directly with each of their competitors. Indeed, this level of interconnection would likely be inefficient and costly. Therefore, we reasonably assume here that these carriers will employ a third party or "backbone" provider to connect to their competitors.

Carriers that serve more than one region are more likely to have sufficient traffic to justify direct connections to their competitors. Indeed, carriers that exchange large amounts of traffic could reduce costs by interconnecting directly instead of through a third party. Therefore, we reasonably assume that carriers serving two or more regions will interconnect directly with all like-sized competitors (i.e., all other carriers that also serve two or more regions).

According to market data provided to TRA by the Strategis Group,[39] there are 84 different carriers operating in at least one of the 100 largest MSAs. Of these carriers, 48 serve only one region. The remaining 36 serve two or more regions. These carriers are listed in Appendix A at the end of this report. Based on our assumption that each carrier will have one STP pair to perform LSMS, number portability database and GTT functions, there will be a total of 168 STPs in the 100 largest MSAs.

In addition, as indicated above, we assume that carriers serving more than one region will interconnect with each other directly. Based on this assumption, a total of 2,520 SS7 facilities will be required to achieve these interconnections.[40] Again, we reasonably assume that smaller carriers (i.e., those serving only one region) will not have sufficient traffic to justify direct connections with competitors, and will use a third party provider. Therefore, no additional SS7 facilities are required for these carriers.

By multiplication, the capital cost for software upgrades would be approximately $93.7 million[41] for the top 100 MSAs. The capital cost of SS7 ports would be an additional $5.04 million.[42] In total, the capital cost of implementing service provider number portability based on the LRN-Relay approach in the 100 largest MSAs for all carriers would be

[39] Strategis Group - wireless carriers with FCC licenses in the 100 largest MSAs.
[40] 35 (number of connections to competitors) X 36 (number of carriers that need to interconnect) X 2 (each STP in pair) = 2,520.
[41] $557,500 X 168 (84 STP Pairs) = $93,660,000.
[42] $2,000 X 2,520 (SS7 ports needed to interconnect 36 carriers) = $5,040,000.

approximately $98.7 million.[43] On a per POP basis, this equates to a capital cost of $0.61 per POP.[44]

2) Recurring Costs

To develop an estimate of recurring costs for the LRN-Relay solution, four additional factors must be determined – the number of SS7 links needed to interconnect the 36 carriers serving more than one region, the number of subscribers in the 100 largest MSAs that are likely to port their numbers, the average daily registration notifications each subscriber would likely make, and the cost of each database query or dip.

With respect to the recurring cost of SS7 links, we assume that each link will cost $500 per month. While it is unlikely that each link will cost this much under the applicable interconnection agreements between the various carriers, we assume this figure to provide the most conservative estimate possible. Based on this figure, SS7 links would cost $6,000 annually. Using the 2,520 SS7 facilities discussed in the previous section, SS7 links for the 36 interconnected carriers would cost approximately $1.26 million per month, or $15.12 million annually.

With respect to the number of subscribers that are likely to port their numbers to other carriers, we must determine two factors: a) the total number of subscribers in the 100 largest MSAs; and, b) the percentage of subscribers that may port their numbers.

Because wireless subscribership is more likely to be concentrated in densely populated areas than wireline subscribership, we assume that 85 percent of the total industry subscribership resides in the 100 largest MSAs. This is a conservative assumption given the fact that the FCC determined that only 61.1 percent of wireline subscribers lived in the 100 largest MSAs.[45]

Further, we assume that 30 percent of subscribers in the 100 largest MSAs will port their numbers to other carriers each year. This is a conservative assumption given the fact that the industry "churn" rate has historically averaged approximately 24 percent per year. While it is unlikely that 30 percent of subscribers will port their numbers to other carriers in the first few years when service provider number portability becomes available, we make this assumption so as to provide the most conservative cost estimate possible.

With regard to dip charges, recent press reports indicate that backbone providers are expected to charge approximately $0.003 per dip.[46] While these costs are likely to go down

[43] $93,660,000 + $5,040,000 = $98,700,000.
[44] $98,700,000 / 162,088,391 (POPs) = $0.61.
[45] *Third Report and Order*, CC Docket 95-116, RM –8535, FCC 98-82, May 12, 1998, paragraph 477.
[46] *All work and no pay? Service providers have been dashing to deploy LNP by the deadline. But who's going to foot the bill?*, America's Network, October 1, 1997. *Panicking portability. Technically wireless number portability is poised to make an end run – if the wireless industry doesn't block it first.*, America's Network, October 1, 1997. AG Communication Systems, Products & Services, Number Portability Problem Overview (available as of November 17, 1998 at *http://www.agcs.com).*

over time as network traffic increases and economies of scale are realized, $0.003 is used here for comparison purposes.

We reasonably assume here that each subscriber generates 52 registrations per month.[47] Based on the FCC's projected subscriber growth for cellular and PCS subscribers, as shown in the table below, we estimate that on average 19.8 million subscribers in the largest 100 MSAs would be likely to port their numbers to other carriers each year[48] for the next three years. Given this number of subscribers, we further estimate that an average of approximately 1 billion registration messages will be generated each month that must be queried.[49] On an annual basis, this equates to an average of 12.4 billion messages.[50] Therefore, by multiplication, the average annual recurring cost of database queries will be approximately $37 million.[51]

Carrier Type/ Year	Total US Subscribership	Subscribership in Top 100 MSAs
Cellular		
1998	59,844,000	50,867,400
1999	66,364,000	56,409,400
2000	71,228,000	60,543,800
PCS		
1998	6,381,000	5,423,850
1999	11,517,000	9,789,450
2000	17,549,000	14,916,650

In total, the annual recurring cost of implementing the LRN-Relay solution in the 100 largest MSAs is approximately $52.2 million.[52] On a per POP basis, this equates to $0.32[53] annually per POP.

[47] This figure is reasonable given the fact that: a) the average subscriber logs 120 minutes of air time each month; b) the average call length is 2.31 minutes according to CTIA – which equates to 51.95 calls per subscriber per month; and, c) each call generates one registration message.

[48] *Third Annual CMRS Competition Report*, Table 5D, at B-8. Subscribership - 66,225,000, 77,881,000, and 88,777,000 (in years 1998, 1999, and 2000 respectively) X .85 (percentage in 100 largest MSAs) / 3 (for years 1998, 1999, 2000) = 19,795,055 per year.

[49] 19,795,055 (ported subscribers) X 52 (registration messages per month) = 1,029,342,860.

[50] 1,029,342,860 (monthly registration messages) X 12 = 12,352,114,320.

[51] 12,352,114,320 (annual registration messages) X $0.003 (dip charge) = $37,056,343.

[52] $15,120,000 (SS7 links) + $37,056,343 (database query charges) = $52,176,343.

[53] $52,176,343 (total recurring cost) / 162,088,391 (population in 100 largest MSAs) = $0.32.

3) Total Costs

In summary, a conservative estimate of the cost of implementing the LRN-Relay solution in the 100 largest MSAs would include a one-time capital investment of approximately $98.7 million (or $0.61 per POP) and annual recurring costs of approximately $52.2 million (or $0.32 per POP) for each of the next three years.

MIN/MDN Separation Solution

The MIN/MDN separation solution requires carriers to upgrade their networks to support the new separation technology. No additional SS7 links or ports would be required. However, implementation of the MIN/MDN separation solution faces significant cost hurdles.

Assuming standards have been finalized and hardware and software products that support those standards are available, every wireless carrier is required to deploy this functionality. This is required regardless of a carrier's location.

The Yankee Group reports that wireless carriers will have to spend up to $1 billion over a three-year period to upgrade their networks for number portability.[54] This report indicates that MIN/MDN separation is necessary. Assuming the accuracy of this estimate, this could equate to as much as $6.17 per POP[55] in total capital costs.

6.2 Deployment Outlook

LRN-Relay Solution

Because the LRN-Relay solution requires only minor modifications to the network infrastructure implemented to support call routing to ported numbers, implementation of this solution would be expected to be rapid. Indeed, the only modification that must be made on a uniform basis is the software change order at the NPAC. This change order is necessary to associate the appropriate HLR of the recipient carrier to whom a subscriber ports a number.

NPAC change orders, however, are not difficult to obtain and can usually be completed in a limited amount of time.[56] For example, Change Order NANC No. 203 was requested and approved by the wireless industry for short message service.[57] This change order is expected to be released in the second quarter of 1999. The modifications requested in this change order are nearly identical to the changes that would be necessary for LRN-Relay.

[54] *Wireless Number Portability: A Bowl Full of Cherries for Competition...but Just the Pits for Everyone Else?* The Yankee Group, Wireless/Mobile Communications, North America, REPORT Vol. 6, No. 6-March 1998.
[55] $1,000,000,000 / 162,088,391 (POPs) = $6.17.
[56] The NANC change order process exists to regularly update the NPAC capabilities.
[57] NANC Change Order No. 203 represents the 203rd time a change to the NPAC capabilities have been considered since its inception.

With respect to network modifications, only the networks of carriers serving areas within the 100 largest MSAs will be affected by this solution. Carriers that serve areas outside the 100 largest MSAs would not have to upgrade their networks to implement LRN-Relay.

For carriers that serve areas where number portability is required, implementation of the necessary network modifications also is expected to be rapid. Carriers serving these areas will already have the network infrastructure required for call routing purposes. In addition, if this infrastructure was recently purchased and installed, the necessary GTT software may already be loaded on the STP. Indeed, it is becoming industry practice for hardware vendors to offer GTT software with their products.[58] This will make implementation of LRN-Relay especially convenient for carriers that are still building their networks – such as PCS carriers.

It should be noted that because carriers serving areas outside the 100 largest MSAs will not be required to change their current operations under LRN-Relay, they will automatically forward roamer registration notifications to the donor carrier as they do today. However, since donor carriers have the ultimate responsibility for ensuring that the necessary number portability database queries take place and that registration messages are forwarded to the appropriate HLRs, there is no conflict.

MIN/MDN Separation Solution

As discussed above, the MIN/MDN separation solution requires all carriers to upgrade their networks. As a result, implementation of the MIN/MDN separation solution faces a number of significant deployment challenges and is expected to be time consuming.

First, MIN/MDN separation standards have not yet been finalized. Without these standards, hardware and software vendors are unable to develop products that support MIN/MDN separation. CTIA notes in its report on wireless number portability that standards historically take up two years to develop.[59]

Second, the lack of finalized standards has prevented hardware and software vendors from developing products to support MIN/MDN separation. While preparatory plans can be developed for MIN/MDN products, production and testing must still take place once standards are available. It is unclear at this time what, if any, products have been designed to support MIN/MDN separation. AT&T refers to such activities in its Reply Comments filed in the FCC proceeding regarding the NANC Report.[60] However, no specific activities are quantified.

[58] Vendors such as Tekelec, Alcatel (formerly DSC), Evolving Systems and AG Communication Systems offer GTT software for their products.

[59] *CTIA Report on Wireless Number Portability*, Version 2.0, July 7, 1998, page 18.

[60] AT&T Reply Comments, *Telephone Number Portability, North American Numbering Council (NANC) Recommendation Concerning Local Number Portability Administration, Wireless and Wireline Integration*, CC Docket No. 95-116, NSD File No. L-98-84, August 31, 1998, page 7.

Third, as indicated in the previous section, every wireless carrier is required to deploy this functionality. If the cost estimates for network upgrades are accurate, smaller carriers may have difficulty deploying them.

Finally, implementing MIN/MDN separation throughout carrier networks will require a nation-wide cut-over to the new technology. Indeed, without this flash-cut, some networks would not be able to forward registration messages appropriately. The flash-cut would essentially have to be performed simultaneously nation-wide. The coordination alone could be highly complicated.

6.3 Impact on Current Providers

LRN-Relay Solution

As discussed above, carriers that serve areas outside the 100 largest MSAs are not affected by implementation of the LRN-Relay solution. There is no requirement under the LRN-Relay solution that these carriers upgrade their network facilities, develop procedures to handle new network functions, or negotiate third party agreements to perform additional routing tasks. Indeed, these carriers would not have to alter their current procedures to enable wireless number portability in the 100 largest MSAs.

Carriers that serve areas where number portability is available (those areas within the 100 largest MSAs) would likely be affected to some degree under the LRN-Relay solution. The impact these carriers may experience relates to their status as donor or recipient carriers.

As discussed in the previous sections, a donor carrier's responsibilities in a specific market will change after number portability implementation. The LRN-Relay solution requires that these carriers have the responsibility for ensuring that the necessary database queries for ported numbers are performed and that roamer registration notifications are forwarded to the appropriate HLRs.

Donor and recipient carriers must also be capable of interfacing with existing number portability databases to perform the actual porting of new customers. This is either done directly through the NPAC or through an intermediate LSMS interface. Recipient carriers must also be capable of recognizing when a donor carrier has already queried a number portability database for a subscriber that has ported its number to them.

In either case, carriers that serve areas within the 100 largest MSAs would only be affected in those locations where wireless number portability is available, and only to the extent that they serve as a donor or recipient carrier.

MIN/MDN Separation Solution

The impact on existing carriers under the MIN/MDN separation solution is quite different than under the LRN-Relay solution. Indeed, the impact would not be tied to a carrier's role within a wireless market. Rather, all carriers, regardless of their location with respect to the

100 largest MSAs would be affected. All carriers would have to upgrade their networks so as to be capable of recognizing separate MINs and MDNs.

With the exception of GSM networks, MIN/MDN separation is an entirely new function in most wireless networks. As a result, technologies must be developed to implement this function. Currently, standards bodies, hardware and software manufacturers, and wireless carriers are developing MIN/MDN separation methodologies. However, it is unclear at this time when network upgrades will be available.

Because the cost of network upgrades, when they become available, is likely to be somewhat fixed, the impact of MIN/MDN separation will fall disproportionately on smaller carriers that serve areas where wireless number portability is not available. Indeed, the network upgrades these carriers would be required to make would not necessarily provide their subscribers with number portability.

APPENDIX A

WIRELESS CARRIERS SERVING THE 100 LARGEST MSAs BY REGION

Carrier	Ameritech	Bell Atlantic	BellSouth	NYNEX	PacTel	SBC	US West
21st Century Telesis	X	X		X			
360 Communications Company	X	X	X		X		
ACC-PCS				X			
Aer Force Communications		X			X		
Aerial Communications	X	X	X			X	X
AirGate Wireless			X				
AirTouch Cellular	X		X		X		X
Aliant Communications							X
ALLTEL Mobile Communicatio			X			X	
Alpine PCS	X				X		
American Cellular Communications Corp.	X		X		X		
Americall International						X	
Ameritech	X						
American Cellular Communications Corp.	X		X		X		
AT&T Wireless	X	X	X	X	X	X	X
Bakersfield Cellular Telephone Company					X		
Baton Rouge Cellular Telephone Co. Inc.			X				
Bell Atlantic NYNEX Mobile		X	X	X		X	X
Bell South Wireless			X				
BTA Ventures II			X				
Carolina PCS 1 Limited Par			X				
CCPR Services Inc.			X				
Centennial Communications	X		X				
Central Oregon Cellular					X		
Central Wireless Partnersh					X		
Century Personal Access Ne	X		X				
Chase Telecommunications L			X				
Cincinnati Bell Telephone	X						
ClearComm			X				
CM-PCS Partners							X
CMT Partners					X		
Comcast PCS Communications		X					
Communications Venture PCS	X						
ComScape Telecommunication			X				
Cook Inlet Western Wireles	X					X	X
DCC PCS						X	
Denver and Ephrata Telepho		X					
Devon Mobile Communication		X	X	X			
Digiph PCS			X				
Fortunet Communications				X			X
Frontier Cellular				X			
GTE Wireless	X	X	X		X	X	X
GWI PCS			X		X		
Honolulu Cellular					X		
Houston Cellular Telephone						X	
Indus	X						
Iowa L.P.							X
Magnacom Wireless					X		X
McLeod							X
Mercury Mobility			X			X	
Meretel Communications LP			X				
Nextwave Personal Communic	X	X	X	X	X	X	X
Northcoast Operating Co.	X	X		X			X
Northeast Nebraska Telepho							X
Ominipoint Com	X	X	X	X		X	
Pacific Bell					X		
PCS 2000 LP					X		X
PCS Devco	X						
Pocket Communications	X		X		X	X	X
Poka Lambro PCS						X	X

APPENDIX A

WIRELESS CARRIERS SERVING THE 100 LARGEST MSAs BY REGION

Carrier	Ameritech	Bell Atlantic	BellSouth	NYNEX	PacTel	SBC	US West
Powertel			X				
PrimeCo	X	X	X		X	X	
Puerto Rico Telephone			X				
R & S PCS	X						
Radiofone PCS		X	X				X
Rivgam Communicators		X		X	X		
SBC Communications	X	X	X	X		X	
Southern Wireless			X				
Springwich Cellular Partnership Ltd.				X			
Sprint	X	X	X	X	X	X	X
Sygnet Communications Inc.	X						
Telecorp Holding Corp			X			X	
Tennessee L.P. 121			X				
Triad Cellular Corporation						X	
United States Cellular	X		X			X	X
U S WEST Communications							X
Urban Communications PCS		X	X				
USA Micro-Cellular							X
Vanguard Cellular Systems Inc.		X					
Virginia PCS Alliance Consortium			X				
Vtel Wireless, Inc.				X			
West Coast PCS LLC					X		
Western Wireless	X	X			X	X	X
Wireless II							X
TOTAL	28	21	40	15	24	21	25